IC250: Lab assignment 4

This lab makes use of linked lists. A linked list ADT is provided, you can use that or implement your own ADT.

Note: You must use linked lists to solve the questions of this assignment. There are other ways of solving the questions (HackerRank cannot check if you have used linked lists), and hence this must be avoided. Any approach not using linked lists will be considered as cheating.

HackerRank link: `https://www.hackerrank.com/iclab250-4`

1. **Hashing with chaining: an application of linked lists.**

   A hashtable can be used to store information, which can be retrieved using a *key*. The index of the hashtable where the information is stored is computed using a *hash function*. The hash function $h()$ is applied to the key k to get the index of the hashtable (which is typically an array of length M.)

   In case two keys map to the same index, a *collision* is said to occur. One way to handle collisions is to use a technique called *chaining*. Here, all elements that map to the same index is stored as a linked list. The hashtable index j contains a pointer to the head of the linked list of all the elements whose keys hash to j.

   You are given a set of data records, which have to be stored using a hashtable of length $M = 587$. The record consists of six fields:

   - IdNumber (key)
   - FirstName
   - LastName
   - DOB
   - City
   - Dept

   Apply the following hash function:

   $$h(\text{IdNumber}) = \text{IdNumber} \mod M$$

   where $\mod$ is the modulo operator. Use chaining to resolve collisions. After storing all the records, print the length of each linked list in the hashtable. Records of sizes ranging from 100 to 20,000 are provided as test cases in HackerRank.

2. **Linked list operations.** Perform operations `insert()`, `getLength()` and `delete()` on a linked list. The data and operations are provided as test cases in HackerRank.

3. **Reversing a string using a linked list**. Create a string as a linked list, using a sequence of `insert()` operations. Then print the string in reverse. You must use only constant amount of storage in addition to the list itself.